

Effectiveness of Seed-soaked Cu, Autumn- Versus Spring-applied Cu, and Cu-coated P Fertilizer on Seed Yield of Wheat on a Cu-deficient Soil

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Yield responses of cereals to Cu fertilization have been investigated in western Canada, but for economic reasons producers have demanded information regarding low-rate application strategies in preventing/correcting Cu deficiency on wheat. Field experiments were conducted to determine the effect of seed-soaking of Cu fertilizer (Experiment 1), autumn- vs spring-applied Cu (Experiment 2), and Cu-coated P fertilizer (Experiment 3) on seed yield of wheat on a Cu-deficient soil at Porcupine Plain in northeastern Saskatchewan. The rates of applied Cu in different experiments were: seed-soaked Cu @ 30, 60, 120 and 240 g Cu 100 kg⁻¹ wheat seed; foliar Cu @ 0.25, 0.50 and 1.00 kg Cu ha⁻¹ applied at flag-leaf and/or at tillering; granular Cu @ 2.00 or 4.00 kg Cu ha⁻¹ surface broadcast and incorporated into soil just prior to seeding or pre-emergence surface broadcast; TSP with 1% Cu in granules; plus zero-Cu control. In all 3 field experiments, wheat showed severe Cu deficiency in all years. There was a substantial increase in seed yield with proper application of Cu fertilizer, but the yield response to applied Cu varied in different experiments due to variation in placement method, timing of application, formulation and rate of Cu. In Experiment 1, seed-soaked Cu at very low rates increased seed yield of wheat, but the increases were lower than foliar applied Cu at low rates (0.50 to 1.00 kg Cu ha⁻¹) or soil incorporated Cu at high rates (4.0 kg Cu ha⁻¹). Seed yield was highest with two foliar Cu applications > soil incorporated Cu > one foliar Cu application > seed-soaked Cu. In Experiment 2, For granular Cu, seed yield increased only when Cu fertilizer at 4.0 kg ha⁻¹ rate was applied in previous autumn. For spring application, seed yield increased only when solution Cu fertilizer at 4.0 kg ha⁻¹ rate was spray-broadcast on soil surface and incorporated into soil prior to seeding. In Experiment 3, Seed yield increased considerably when Cu fertilizer at 4.0 kg ha⁻¹ rate was broadcast and incorporated into soil at seeding. Application of Cu in TPS fertilizer granules had little effect on seed yield. In conclusion, the findings suggest that Cu deficiency in wheat can be corrected with soaking wheat seed in Cu solution, but potential for yield increase may not be as high as foliar applied Cu or soil applied Cu. Deficiency of Cu in wheat can be corrected by surface-broadcast of Cu fertilizer at relatively high rates in autumn, followed by incorporation into soil at seeding or by surface-broadcast of solution Cu fertilizer (most likely due to dispersion of Cu ions in the soil over the winter).